

Scheduling disciplines for the $G/G/k$ queue - Homework Assignment (DM), Évaluation de Performances, INFO4 Polytech Grenoble

ANSELMi Jonatha

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Votre devoir sera rédigé en français ou en anglais sous forme d'un document HTML généré à l'aide de R/Markdown et publié sur rpubs en prenant soin de bien laisser le code apparent et de fixer la graine de votre générateur à l'aide de la fonction `set.seed` au tout début du document afin qu'il soit possible de reproduire vos données avec exactitude.

Vous enverrez l'URL rpubs de votre devoir par mail à jonatha.anselmi AT inria.fr avant le 2023-03-31 à 12h00 en indiquant dans le sujet [INFO4-EP] DM.

Objective

The aim of this homework assignment is to be able to simulate and compare the dynamics of a $G/G/k$ queue adopting a number of scheduling disciplines.

The student will rely on the code written in class for simulating the dynamics of the $G/G/1$ queue, which is available at https://rpubs.com/janselmi/GG1_scheduling_disciplines

Roadmap

1. Extend the R code of the $G/G/1$ queue to be able to simulate the $G/G/k$ queue under the scheduling disciplines FCFS, LCFS, ROS and SRPT.
2. Take $k = 3$. Simulate the dynamics induced by 10 arrivals and provide numerical evidence that your code is correct (using the `print` command or similar commands).
3. Now, the goal is to compare the $G/G/k$ queue with a $G/G/1$ queue having one server that is k times faster. For increasing values of the load (i.e., arrival rate divided by service rate) and $k = 5$, plot the ratio between the average response time obtained by a $G/G/k/FCFS$ queue and the average response time obtained by a $G/G/1/FCFS$ queue with a server that operates at speed k .
4. Find the value of the ratio defined in the previous point in a limiting regime where the load approaches one from below. Provide some intuition for the obtained value.

Assumptions

- For the inter-arrival and service times, the student is free to choose the probability distributions of their choice.
- In the $G/G/k$ queue, it is assumed that each server processes jobs with speed one.

Notes

Beyond the correctness of the 4 points above, the final note will depend on how the student will make their homework clear. In particular,

- Justify any further assumption made.
- Add comments in the code to explain what you are doing.
- Make sure your plots are *robust* (in terms of number of simulated jobs, choices of k , etc.).